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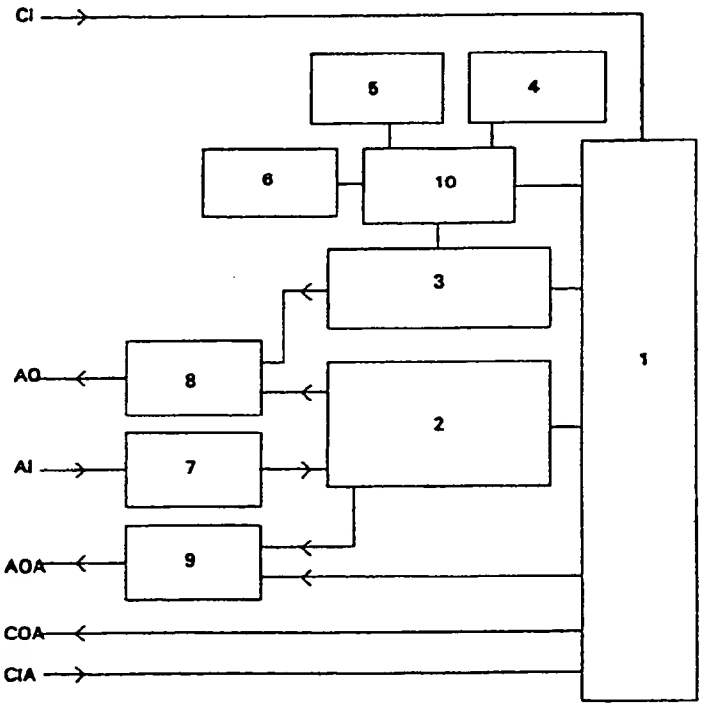
(54) Title: A SPEECH MESSAGE RECORDING DEVICE

(57) Abstract

The invention is directed to a digital audio recorder having means for recording, short-term storage, archiving, searching, playback and "speaking" time verification of audio which is transmitted electro-magnetically, electrically, optically or otherwise, comprising a control unit (1) sensing control signals CI and controlling the system according to the content of said signals, input (7) and output (8) units for audio AI AU, a digital memory (2) in which the audio is stored in digital form, a search code generator (6) generating information about the storage position of recordings, a time code generator (4) generating information about recording time, a block code generator (5) generating an erasing block for archiving selected recordings, an archiving output unit (9) for supplying audio manually or automatically AOA for archiving in an external archive memory by using control and check signals CIA COA, a code list (10) comprising memory means for storing a set of said codes for each recording, and a code-to-speech converter (3) for "speaking" verification of recording time during search and playback.



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A Speech Message Recording Device.

The invention is directed to a speech message recording device, named audio recorder in the following, at a reception station which may be controlled by an operator, e.g. a central alarm office, comprising digital memory means for storing said speech messages and the arrival time of each speech message, means occasionally having A/D-converters respectively D/A-converters for the input/output of said speech messages, and means for searching and retrieving the information which is stored.

Field of technology

The rapid growth in the telecommunication area brings with it consequent great demands for possibilities of documenting and saving of audio transmissions during longer or shorter time periods. The object is to make possible a later check and analyse of the content of the information which is transmitted. One example is the central alarm offices being set up successively in Sweden and other countries. In this practical situation there is a demand for long-term storage (archiving) as well as a very manifest demand, from emergency-operators, for possibilities to achieve a rapid retrieval and check of newly recorded information. The SOS-system CoordCom of the Swedish Telecom has integrated into it equipments meeting said two demands.

Traffic control is another field in which audio recording is of vital interest. One special area within this field is the communication between control officers and airplane crews. Coast guard is another example of situations in which the above mentioned demands are strong, but the use of technology for audio recording is very well possible also within an area as disperate from the mentioned areas as business operations. The demand in business relations manifests itself when it is necessary to have a documentation of verbal business agreements, e.g. trading of stocks and currency.

In most cases so called logging tape recorders are currently used for long-term storage, in which the magnetic tapes are replaced for archiving when filled. For example, multi-channel tape recorders are used with a very long recording time, in which many separate telephone lines are recorded in parallel. The cost per line is reduced by using a common tape

recorder for many lines, but searching in information on the tape being recorded is blocked, because the recording state is common and must be finalized on all lines for a search to be initiated.

Single channel short-term storage systems without archiving but only saving information during a defined time period are used in environments needing an uncomplicated search and check of newly recorded information. All information shall be guaranteed not to be erased within this time period. On the reverse, after said time has elapsed, over-writing of the oldest information takes place by arriving new information.

Current Technology and Problems thereof

1.
Currently used recording equipment has primarily two strictly different modes of application (archiving or short-term storage) and are not fitted for combined recording needs. Due to this inconvenience the customer in some cases must install double equipments, like for example in the case of said CoordCom. If only one type of equipment is installed, for example of economic or space reasons, the consequence may be difficult user routines.

A short-term storage system may be used as an example. In this system the magnetic tape is normally not changed when it is full, but over-writing directly takes place by new information. This means that archiving does not take place, but the storage time will be the same as the total tape recording time. If a need of archiving will suddenly appear with respect to a given recording, the running magnetic tape must be displaced manually in order to be saved and be replaced by a new one. This must take place before the end of said defined storage time (i.e. the tape recording time) and over-writing automatically takes place. Being basically a short-term storage system, the time may be short if the tape recorder is not immediately available for the user, being often the case.

2.
When the recorded information is retrieved a need often arises to know the exact time of recording. Several contemporary solutions for this problem are known. One prior art solution is to store a time information

(time code) together with the recording, for example by mixing "speaking clock" into the background of the recording. This solution will naturally disturb the playback of both recording and time code when the two simply will "speak at the same time". Furthermore, continously keeping a telephone connection to "speaking clock" is expensive and in some cases practically impossible.

Other solutions are of a type in which a digital time code is recorded in parallel with but separated from the information to be stored. During playback the time code is displayed as signs on a numerical display. Problems appear because of the fact that the user is often at a distance and has not said numerical display available for reading, for example in case the playback is distributed via telephone lines.

3.
As a storage medium is currently used a magnetic tape alternatively magnetic disks (so called permanent or hard disks). The information is stored in an analogue or a digital form. Both of these storage media are based on moving mechanical systems, of which the life time is limited by reasons of construction.

Magnetic tape based systems show an extensive and continuous need of service and maintenance in order to preserve a high reliability of operation. This is due to the contamination and wear going on continuously when the magnetic tape is transported in direct contact with recording and playback mechanics (so called tone heads).

Hard discs have a small air gap between tone head and magnetic disc which eliminates wear and contamination. Unfortunately the precision of the air gap is a sensitive matter because of the fact that disc and tone head will be damaged if coming into contact with each other. This makes the hard disc shock sensitive and directly inadequate for mobile purposes, for example. The life time is also limited by the fact that the magnetic disc is rotating continuously during operation, with a consequent wear of bearings and other built-in mechanics of the tone heads.

4.

The magnetic tape based systems have most often very long access times because the length of the tapes is very great and the same must be reeled between storage reels in order to reach a desireable position. An effective search in recorded material is complicated by the slowness.

The Object of Invention.

Starting from observed needs the object of invention is to provide a device not showing the drawbacks of prior art technology and being useful for both short-term storage and long-term storage.

The object of invention is obtained by a device of the kind mentioned in the opening paragraph which, according to the invention, is characterized by a short-term memory of semiconductor type for short-term storage of received messages, an output to an archive memory for long-term storage/archiving of speech messages transferred from the short-term memory, operator means for selectively establishing an erasing/over-writing block for a speech message which is stored in the short-term memory, and means for an automatic or operator command controlled transfer of a blocked speech message from the short-term memory to the archive memory.

In a preferred embodiment of the invention said short-term memory is a cyclically operating internal memory of a limited storage capacity in which over-writing of non-blocked speech messages automatically takes place by new speech messages when the storage capacity is fully occupied, said archive memory being an external memory of a larger storage capacity for storing blocked speech messages from the short-term memories of several speech message recording devices.

By the invention long-term archiving is made possible of selected parts of the information in a system which is based on short-term storage for high-speed checks during emergency situations. By combining long-term storage internally in the audio recorder by means of an over-writing block for selective information, and externally by means of an automatic output to an archive recorder/memory used in common by several audio recorders, a solution is obtained which is safe, remote controllable and economically advantageous.

By using semiconductor memories (no moving parts) as a storage medium a reliable operation is safeguarded, and freedom of maintenance is obtained as well as an operation reliability which is superior in all environments in comparison with the currently used magnetic storage technology. The semiconductor memories have been successively miniaturized during the last years, consequently the invention may be realized today on one single circuit board by using available semiconductor technology, also allowing a multi-channel system in e.g. one single 19" standardized box.

The audio information is digitally stored in the semiconductor memory 2 according to Figure 1. If necessary the audio input units 7 and output units 8, 9 may convert an analogue audio signal to/from a digital signal during input/output.

Preferably, the device according to the invention comprises a defined memory or memory location which may be controlled and searched separately, and a block code generator which may be controlled by said operator means for the generation of a block code for a selected speech message, said block code being stored in a code list in said defined memory or memory location.

This allows for archiving and storage and later output of important information by means of a command CI, saying that a block code of selected recordings is generated 5 and stored in a code list 10, blocking the same from being erased also after the storage time is exceeded, that is when over-writing should have taken place. In order for blocked areas not to occupy a too large space in the memory 2, blocked information is drained from the semiconductor memory for archiving on another storage medium via the audio output AOA. This is done automatically or by means of a simple command CI, and then the audio recorder as a first step checks via control signals CIA if the archive recorder is available and ready (it may be used in common by several audio recorders). Thereafter a record start signal COA is transferred to the archive recorder and at the same time an output AOA is started of the blocked information in either analogue or digital form. It is understood that the block code may be inactivated at any moment.

In order to obtain a rapid and effective access during a search in stored audio information, a search-code organized storage structure is used. In combination with semiconductor memories as a storage medium this means practically instantaneous access to all material which is stored.

A further preferred embodiment of the invention is accordingly characterized by a search code/address generator for generating information about the short-term memory storage position of each speech message, and a time code generator for generating information about the arrival time of each speech message, the search code and its associated time code of each speech message being stored in said code list together with an occasional block code, arrival time verification and retrieval of a speech message being obtained by searching said code list.

An integrated search code generator 6 generates a digital search code comprising information about the storage position of each recording in the digital memory 2, the code being stored in said code list 10. The stored search codes allow for a rapid and simple search and access to the stored information 2, because the speed of the semiconductor memories makes possible a playback start from any storage position, and because the list of search codes makes possible a rapid finding of the record, which is desirable for playback.

The system of search codes also eliminates over-writing of newly recorded information even if a search or a playback in the same is going on when a recording command CI arrives. This is obtained by the fact that the search codes in the code list 10 of the most recent recording are checked at the start of a new recording, and that the new recording is stored in succession after the preceeding recording in the semiconductor memory 2. When the recording is ended the new search codes are added to the code list 10. From this follows that the audio memory 2 is always used circularily, meaning that it is only the oldest information which is erased and that the storage time will be at least equal to or longer than the total recording time of the memory. The storage time depends on whether recording takes place continuously or intermittently, because the memory will be filled more slowly in case of interrupts between the recordings.

The use of time codes provides for a unique non-disturbing solution for time verification in case of a remote controlled use. In order for this to be obtained, a further embodiment of the invention is characterized by a time code-to-speech converter for converting the time code of a speech message into a speech signal, in which said verification of arrival time is obtained by artificial speech, which is supplied via the audio signal output of the short-term memory before starting or during a break in the reproduction of the running speech message, a time information of a desirable position in a speech message being obtained by an automatic recalculation of the time code of the arrival time.

By the fact that the time of recording is stored as a digital code and during a verification is communicated by means of artificial speech to the user, a remote use of the function is easily obtained. The information retrieval is not disturbed by the fact that the verification is done before start or in a playback break.

The integrated time code generator 4 generates a digital time code comprising the recording and arrival time of each recording, and which is stored in said code list 10. In this manner the time of recording may be verified on command during later playback. If a verification command arrives via a control signal CI, the time code of the recording is first derived from the code list 10 by the control system 1. By means of an algorithm of the same the time code is thereafter added to the occasional time difference between the recording start point and the actual playback time (if time verification inside a message is desireable). Thereafter the time code is converted into speech by the code-to-speech converter 3 and the "speaking" time verification is supplied on the audio output AO via the output unit 8.

Description of Drawings

Figure 1 shows a functional block diagram of the device according to the invention.

Figure 2 shows a fundamental block diagram of one embodiment.

Figure 3 shows a functional flow chart of the embodiment disclosed in figure 2.

Figure 4 shows a functional block diagram of a microprocessor controlled device according to the invention.

Examples of Use

A practical example of use of the audio recorder in a central alarm office is described in the following (see figures 2-3).

A person in an emergency situation 21 communicates with the emergency-operator 22 via a telephone line TL. All calls are received by the audio recorder 23 for recording AI. This is activated by control signals CI from the operator's working place. If necessary (for example in order to check what has been said) the operator performs, by using said control signals CI, a rapid search in stored information in the audio recorder and listens to the same together with the "speaking" time verification during playback AO. In case an important call must be saved, for example for the submission of evidence before a court, the operator may block erasing of a selected recording via the control signals CI. At an adequate moment thereafter the important call may be transferred manually or automatically to a single channel archiving equipment 24, which is used in common by several operators. If a ready signal CIA is received from the archiving equipment, and if a control signal for starting of a transmission COA is supplied, the audio information is transmitted via AOA. Several users may be connected at MU.

A functional flow chart as shown in Figure 3 discloses the operation of the embodiment as follows:
Positive decisions are indicated in the drawing by Y.
Negative decisions are indicated in the drawing by N.
31: Start
32: Shall the call be recorded?
33: Store audio and codes in the short-term recorder.
34: Operator check of previously recorded audio?
35: The operator searches desireable information.
36: The audio recorder supplies a time verification to the operator.

39: New time verification wanted by operator?
40: Change of block codes wanted by operator?
41: Operator activates/deactivates selected block codes.
42: Are blocked messages available for supply to archive memory?
43: Is the archiving equipment available?
44: Output from short-term memory to archive memory.

The functional flow chart as described, may be implemented for example by programming a microprocessor according to the following description.

Embodiments

The invention may be implemented according to figure 4, for example by the use of a microprocessor 51 (e.g. type MC68000) having peripheral circuits customarily interconnected with address, data, control and supply voltage lines AB, DB, CB, PI. The basic mode of operation of a system of this kind is considered to be generally known and is not further described in this context.

Software and all instructions for the processor may adequately be stored in a non-volatile so called ROM-memory 52 (e.g. type 27128). Search, time and block codes are stored in the external write- and read-memory, so called RAM (e.g. type 6264LP-3) of the microprocessor.

Control signals CI arrive via an input/output unit 54 (so called PIA e.g. type MC68230) transferring commands arriving to the microprocessor 51, deciding what is to be done by means of the software which is stored in the ROM-memory 52. Indication lamps 61 provides status information by the fact that the processor, assisted by the software, supplies instructions for controlling the outputs of the input/output unit 54.

A large RAM-memory 55 for storing audio input AI is also controlled by the microprocessor 51, said memory comprising one or probably a number of memory packages (e.g. of type TC511000P-12) depending on desirable storage capacity. An input unit 57 (so called A/D-converter e.g. type MAX160CPN) converts in usual manner arriving analogue electric audio wave forms AI into digital codes which may be transferred by the micro-

The exact position in the audio memory 55 of each recording is indicated by a search code which is generated by means of the storage position of the previous recording. The search code is stored in the code list 53. During playback the processor 51 derives the audio information in the audio memory 55 by means of said search codes. Thereafter the same supplies the audio information via the output unit 58 (e.g. type NE5018N) re-converting the digital signal into an analogue form AO. In the code list 53, time codes comprising information about the arrival time of each recording are stored as well. Said time codes are generated by a clock comprised in the program software. The crystal oscillator 62 of the microprocessor, providing a fixed frequency, is used as a time base of the clock.

The "speaking" time verification may be implemented by storing speech information comprising enumerated numerals in a non-volatile ROM-memory 56 (e.g. type 27512). During time verification the microprocessor 51 may derive the time code and, starting from the value of the same, supply "speaking" numerals in a proper order to the audio output AO via the output unit 58.

If an instruction arrives about archiving of a recording, i.e. the same is to be protected against erasure, the program software generates a block code in the code list 53 comprising information about the area of the audio memory 55 in which over-writing may not take place. Later on the protected recording may be automatically supplied via the output unit 58 to the archiving output AOA by closing the archiving gate 60 (so called analog gate, e.g. type 4066) by means of the archiving output unit 59 (so called PIA, e.g. type MC68230). The same also senses if the receiving archiving equipment is ready CIA and starts recording on the same COA simultaneously with the audio output.

Preferably the program software shall be structured in such manner that incoming control signals are sensed in a continuously running main program loop. Depending on the arriving command, the program software will jump to a so called sub-routine initiating adequate measures. After ending of a sub-routine a return is made to the main program.

Claims

1. A speech message recording device at a reception station which may be controlled by an operator, for example a central alarm office, comprising digital memory means for storing said speech messages and the arrival time of each speech message, means occasionally having A/D- respectively D/A-converters for the input/output of said speech messages, and means for searching and retrieving the information which is stored, c h a r a c t e r i z e d by
- a short-term memory of semiconductor type for short-term storage of received messages,
- an output to an archive memory for long-term storage/archiving of speach messages which are transferred from said short-term memory,
- operator means for selectively establishing an erasing/over-writing block for a speech message which is stored in said short-term memory, and
- means for an automatic or operator command controlled transfer of a blocked speech message from the short-term memory to the archive memory.

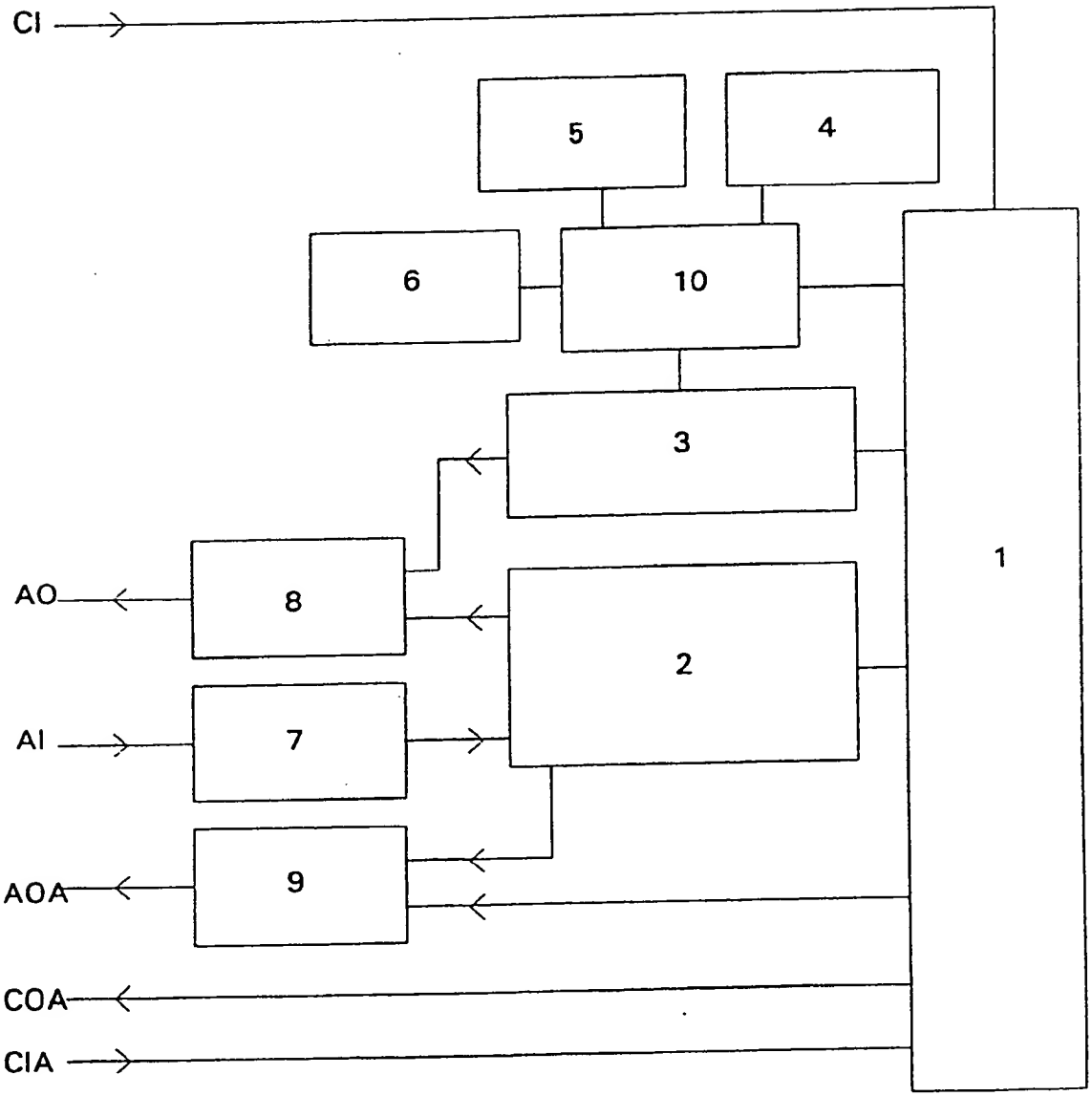
2. A device as claimed in claim 1, c h a r a c t e r i z e d by
- a defined memory or memory location which may be controlled and searched separately, and
- a block code generator controllable by said operator means for the generation of a block code of a selected speech message,
in which said block code is stored in a code list in said defined memory or memory location.

3. A device as claimed in claim 2, c h a r a c t e r i z e d by
- a search code/address generator for generating information about the storage position of each speech message in the short-term memory, and
- a time code generator for generating information about the arrival time of each speech message,
in which the search code of each message and its associated time code are stored in said code list together with an occasional block code, arrival verification and retrieval of a speech message being obtained by searching said code list.

4. A device as claimed in claim 3, c h a r a c t e r i z e d by
- a time code-to-speech converter for converting the time code of a speech message into a speech signal, in which said verification of arrival time is obtained by artificial speech, which is supplied via the audio signal output of the short-term memory before starting or during a break in the reproduction of the running speech message, a time indication of a desireable position in a speech message being obtained by an automatic recalculation of the time code of the arrival time.

5. A device as claimed in anyone of the previous claims, c h a r a c t e r i z e d
- in that said short-term memory is a cyclically operating internal memory of a limited storage capacity, in which over-writing of non-blocked speech messages automatically takes place by new speech messages when the storage capacity is fully occupied, and
- in that said archive memory is an external memory of a larger storage capacity for storing blocked speech messages from the short-term memories of several speech message recording devices.

6. A device as claimed in anyone of the previous claims, c h a r a c t e r i z e d by
- a microprocessor based control unit for controlling the storage, search and retrieval functions of the device dependent on stored control programs and received operator commands.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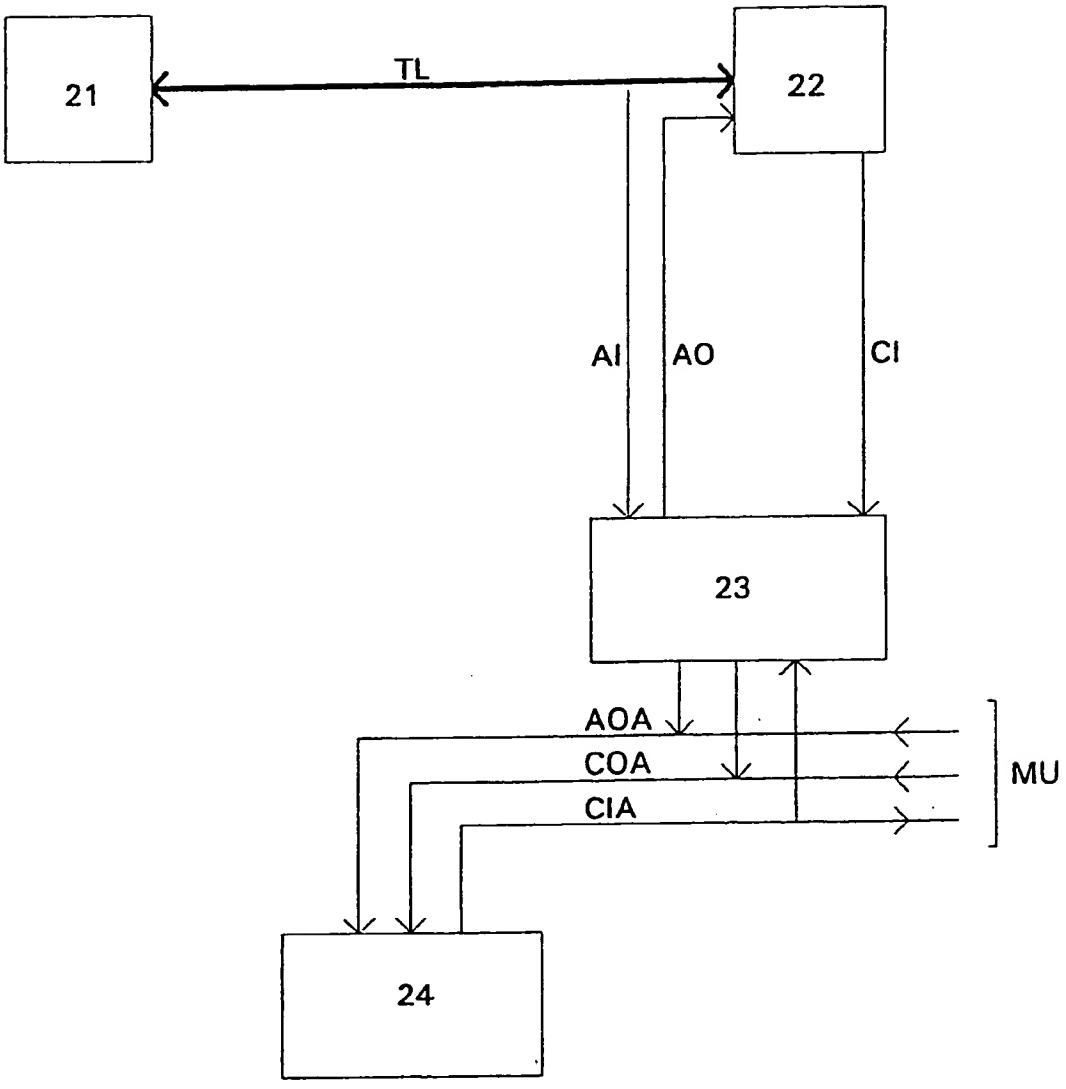
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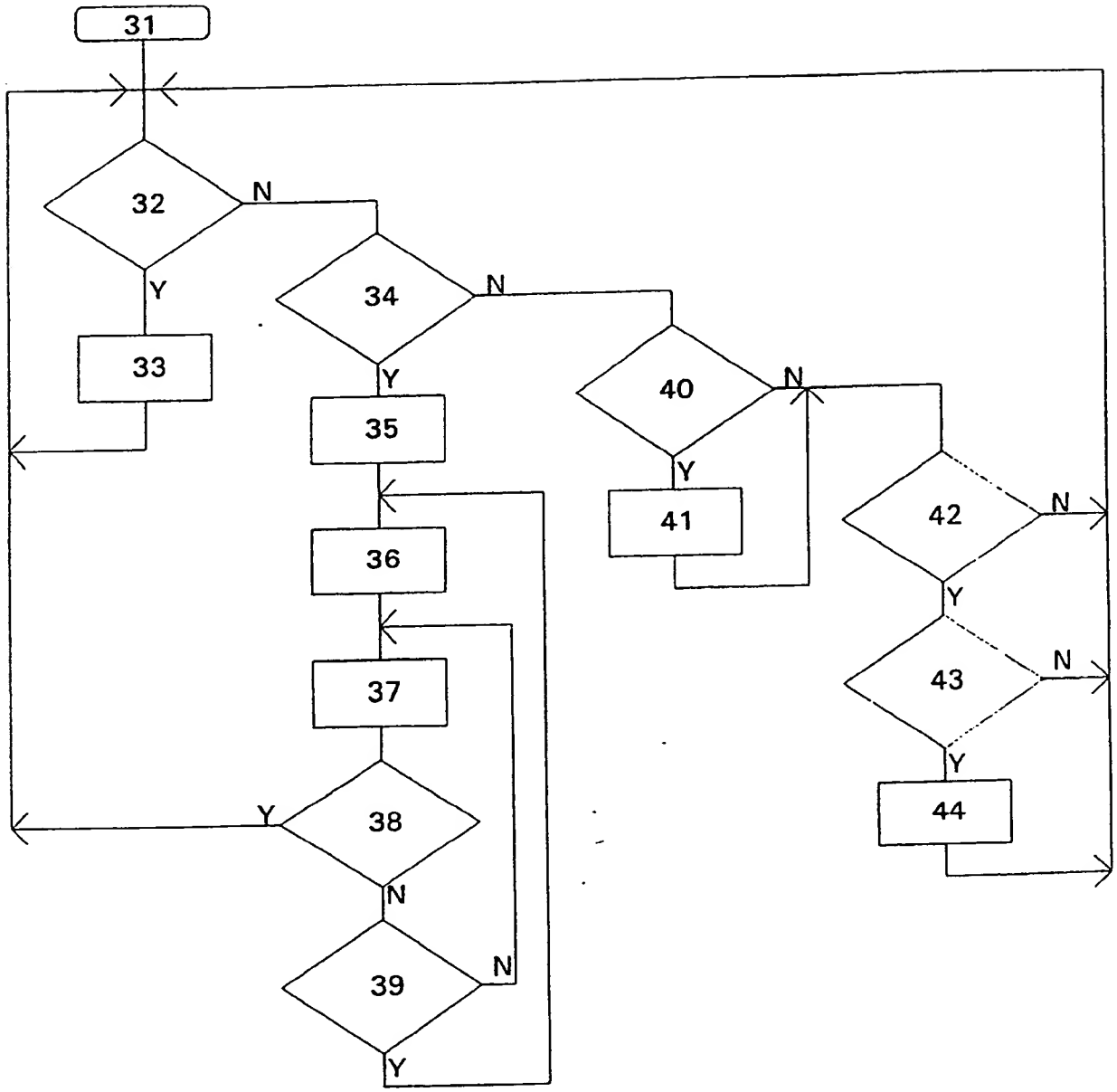
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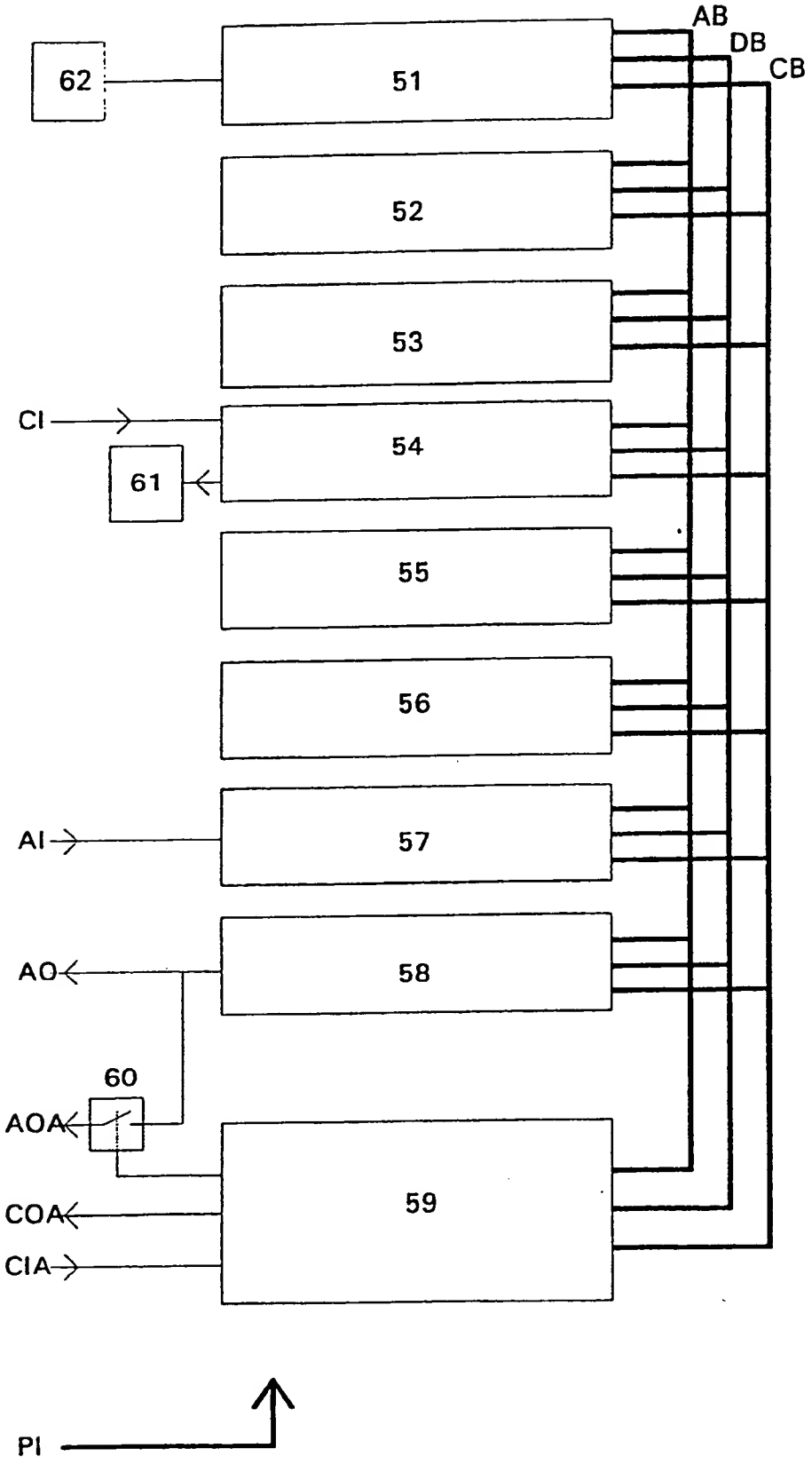
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INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 90/00779

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: G 11 C 7/00, H 04 M 11/00

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	G 11 C, G 08 B, H 04 M

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
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A	US, A, 4255618 (D.W. DANNER ET AL) 10 March 1981, see abstract; claims 1,2 --	1-6
A	US, A, 4829514 (J.J. FRIMMEL ET AL) 9 May 1989, see abstract --	1
A	US, A, 4782510 (A. SZLAM) 1 November 1988, see the whole document --	1
A	US, A, 4856051 (I. OHTAWARA ET AL) 8 August 1989, see claim 1 --	1

* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
12th February 1991	1991 -02- 19
International Searching Authority	Signature of Authorized Officer
SWEDISH PATENT OFFICE	JAN SILFVERLING

Form PCT/ISA/210 (second sheet) (January 1985)

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. PCT/SE 90/00779

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the Swedish Patent Office EDP file on 90-12-28 The Swedish Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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